Next steps in situational awareness
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In the rugged terrain of Afghanistan, it's raining fire, the sound of helicopters and gunfire drowns out voices, and chaos seemingly reigns. This is the fog of war — and the tactical edge.

But what if, hours before engaging the enemy, U.S. forces had tossed a small robot with a built-in camera over a concrete wall or into a burned-out structure to gain a view of enemy activity? And what if those images were logged into a database and accessed by officers planning the assault and by squad members using a handheld computer while advancing on the ground?

Perhaps then the gunfire and helicopters would be those of U.S. forces descending on the adversary, a unified front facilitated by a teamwide plan of action. Whether it was planned hours earlier or unfolded within seconds, that firefight could have been executed with a stream of digital communication.

That is situational awareness. The principle behind it is wide in scope, but in the simplest form, it is knowing what is going on around you.

On the ground during combat, situational awareness is the ability to see what's in the vicinity and anticipate what's not — knowledge that can mean the difference between surviving or being killed in action. Situational awareness is also the integrated web of networks, servers, storage devices, and analysis and management software that ingests data, makes it available for analysis, and then shares it anytime and anywhere, up and down the chain of command.

The Defense Department, in close collaboration with industry, is pressing forward to develop and quickly field new technologies and capabilities on all those fronts. Here is a look at some of the latest developments in three areas.

Extra eyes and ears

Some recent efforts in the unmanned realm focus on systems that can fit in a backpack and serve as eyes and ears in areas too dangerous for troops to physically enter, such as suspicious buildings or a sharp turn in the road ahead.

Those unmanned ground systems are expected to see a downturn in spending beginning in 2013, but development and use will continue, according to several sources.

"When [Defense Secretary Leon Panetta] delivered his strategic vision, he used these words: unmanned systems," said Robert Maline, director of the Joint Ground Robotics Enterprise in the Office of the Secretary of Defense. "The fact that it was mentioned is encouraging to us. We're going to use this to our advantage."

Some of the unmanned systems provide critical reconnaissance that can save lives. "Wherever there's a dangerous situation, an unmanned system could create space between soldier and threat," said Jon Bornstein, chief of the Robotics Autonomous Systems Division and collaborative technology alliance manager at the Army Research Laboratory. "I'd be thrilled if we could get [systems] with the capabilities of a military working dog — understanding the mission, able to operate on its own but staying within boundaries."

One emerging technology is the throwable robot, a device that can be tossed into hostile territory and provide imagery that would otherwise be unattainable.

In February, the Army awarded ReconRobotics a $14 million contract to provide 1,100 of its 1.2 pound, dumbbell-shaped Recon Scout Throwbot. The remote-control device uses infrared optics to see in the dark and relays video. It's the third contract the Pentagon has awarded to the company.

"These robots allow our dismounted troops to have some safety built in with standoff distance where they're investigating in active combat theaters," said Ernest Langdon, ReconRobotics' director of military programs. "Instead of standing on someone's shoulders to see over the eight-foot wall of a compound or throwing a grenade to clear a room and potentially harming people, troops can throw this device in, drive it around and see if there's a threat."

A unified view

Once information is collected from the field — whether it's gathered during patrol or culled from intelligence, surveillance and reconnaissance (ISR) data or other sources — it has to get to the people who need it most, ranging from warfighters on the battlefield to decision-makers higher up the chain of command.

In the settings that have served as the combat theater for the past decade, information access has been a major issue because connectivity can be spotty away from the forward operating bases supplied with fiber optics. That lack of bandwidth can prevent troops in the field from getting timely mission-critical information.

To help meet those needs, each branch of the military is developing its own version of the Distributed Common Ground System (DCGS), a network of deployable nodes that accrue, process and link ISR data across different databases. Data is stored and then uploaded when connectivity is available.

"Historically, you had to go to different locations to get pieces of intelligence," said Col. Charles Wells, project manager of DCGS-A, the Army's version of the program. "If you wanted imagery, you went to the imagery ground station. [DCGS] brings all those types of intelligence together in a single system. An analyst can look at one screen and do robust imagery analysis, signals analysis, human intelligence, biometrics. It's a powerful capability because you're doing multiple-discipline intelligence. It's comprehensive situational awareness about the enemy."

Driving DCGS-A are the move to cloud computing and the need to conserve resources as budgets tighten. The program collapses multiple, redundant systems into one, saving money while streamlining intelligence-gathering across the military services and with coalition partners.

Effectively, DCGS is a tactical cloud for combat operations. "Cloud technology really accelerates this capability because we can store and process massive amounts of data," Wells said. "We can search records back to 2003 in a Google-like search and find people, places [and] locations and show that in a 3-D diagram you can rotate around. That's been a huge paradigm shift."

DOD officials hope that kind of advancement can help prevent the tragic lapses that have resulted from stand-alone systems, like the ones that led to the 2001 terrorist attacks.

"We had a lot of different pieces of intelligence and all this data out there, but it was tough to connect the dots and look at the big picture," Wells said. "That's what this system allows us to do — see the whole picture and find out what's really going on out there."

The situational awareness backbone

If robots are like sensors and DCGS like a collective brain, there needs to be a nervous system that can link all the parts together. Accordingly, the Army is developing a Common Operating Environment that will unify mission communications on a single infrastructure and ease the flow of information. COE is a set of technical standards for interoperability rather than a specific technology.

"COE touches every application-based system in the Army," said Col. John Morrison, director of the Army's LandWarNet/Battle Command. "It's making sure the apps on your handheld work when you need them and, more importantly, that they'll interface with other mission-command applications out there so that information can move seamlessly across boundaries. That's something we haven't necessarily had in the past."

As technologies and communication devices proliferate in the military, making sure they can talk to one another despite their different platforms and operating systems is a growing challenge.

"In a simplistic way, it's sort of like the Internet," Morrison said. "There are all sorts of technologies sitting on the Internet, but they all have to conform to basic technical standards or they aren't connected."

In terms of situational awareness, COE is the foundation that enables troops to share images, video and other data collected in the field with commanders who then make decisions on what to do next.

"This is about seamless situational awareness information used to see where soldiers are and where the enemy potentially is, enabling smart decisions," Morrison said. "It's about making sure it's all integrated appropriately so everyone has the same picture."

COE is being developed and deployed in sets under the Army's ongoing Network Integration Evaluation. The Army will begin fielding components of COE for use in truck platforms and certain devices toward the end of the year, Morrison said. After that, the Army will begin tackling increasingly complex networks.

"People talk about the tactical edge — I think the tactical edge is the soldier," Morrison said. "Connecting that soldier to the network is the highest priority, and it's an operational gap we know is there and we're working on closing rapidly."